periodical fluctuations of the curve are markedly inferior to other and larger variations upon which they appear superposed. . . The range included between these extremes amounts to two seconds, and is altogether too large to be attributed either to personal equation or to any instrumental origin."

THE DISCOVERY OF NEPTUNE.—During a visit to England, in 1876, Prof. Holden was frequently with Mr. Lassell, and he then learned a circumstance connected with the discovery of Neptune which is not without interest. Now that Adams and Lassell are both gone, Prof. Holden has published the brief notes he made at the time, as a contribution to the history of the great discovery. It is well known that, in October 1845, Adams submitted to the Astronomer-Royal his computations indicating the existence of an unknown world beyond Uranus. The work was shown to Dawes, and he was so much impressed by it that he wrote to Lassell, asking him to search for Neptune in the region designated by Adams. Had the discoverer of the two inner and faint satellites of Uranus, and the satellite of Neptune, directed his 2-foot reflector to this region, there is little doubt but that the planet would have been picked up. However, the Fates ordained otherwise: Lassell was confined to his sofa by a sprained ankle, and, when he recovered, the letter of Dawes, giving the predicted place of Neptune, could not be found. It turned out to have been destroyed by a too-zealous maid-servant. Thus, "by a set of curious chances," the new planet was never looked for by the then most powerful telescope and most skilful observer in England. It was not until many months after the letter of Dawes to Lassell that the planet was found by Galle and D'Arrest, near the position given by Leverrier.

ASTRONOMY AT THE PARIS ACADEMY, MARCH 21.—At the meeting of the Paris Academy of Sciences, on March 21, M. Lœwy presented a picture of the Orion Nebula obtained at Toulouse Observatory, with an exposure of five hours, on February 24, 25, and 26.

M. Bigourdan observed Swift's comet on March 17, 18, 19, and 20, and determined its position. He describes it as "a bright nebulosity, 2′ in diameter, without a tail, and with a well-defined stellar nucleus, the light of which is comparable with that of a star of the eighth or ninth magnitude." Denning's comet was seen on March 19 and 20, and five observations of position were made. It is described as "a feeble nebulosity without a tail, 25″ to 30″ in diameter, brighter towards the centre, but without any apparent nucleus. Its light was at the most equal to that of stars of magnitude 13." M. Rayet observed Swift's comet on March 17 and 19, and estimated that its nucleus was of the sixth or seventh magnitude.

M. Terby, in a letter to M. Faye, claims priority for the idea that solar spots and other disturbances on the sun exert an influence on terrestrial magnetism and electricity which varies according to the position of the phenomena with reference to the sun's visible disk. In a paper presented to the Brussels Academy in 1883, "On the Existence and Cause of a Monthly Periodicity of Auroræ," he showed that the fluctuations in frequency of auroræ were connected with the period of the sun's synodic rotation. Hence, some portions of the solar surface seem more capable of exerting terrestrial influence than others.

VARIABILITY OF NEBULÆ.—In NATURE of January 14 (p. 261) some observations were described which seemed to indicate that a nebula in R.A. 3h. 36m., Decl. 95° 2′·1, was variable. Dr. Lewis Swift notes, in *Astronomy and Astro-Physics*, that he has again looked for the nebula, and on January 31 succeeded in getting two glimpses of it, using a power of 195. Although Dr. Swift is not inclined to believe that the nebula is variable, it is strange that he should at one time have picked up the object whilst sweeping, and yet not be able to find it afterwards, even with the most persistent searching. That Dr. Dreyer, also, should have failed to see the nebula on several occasions, although he knew where and what to look for, is almost unaccountable, if the brightness is uniform. It is to be regretted that the illumination of the sky at Rochester, from the electric lights, seems likely to prevent Dr. Swift from continuing his search for nebulæ.

SOLAR PROMINENCE PHOTOGRAPHY.—As the great spot-group of February was again coming round the sun's east limb on March 3, M. Deslandres observed over it a prominence. He also photographed it, and, at the meeting of the Paris Academy of March 14, communicated the results obtained. The Fraunhofer lines H and K are very bright on the photographs, and the entire series of ultra-violet hydrogen lines are plainly visible. Other lines are seen which have not previously been recognized as chromosphere lines, viz. the magnesium triplet about λ 383, and lines at $\lambda\lambda$ 375·93, 376·14, and 368·53, the origins of which are unknown.

THE AURORA SPECTRUM.—The aurora of February 13 was seen at Chicago, and Prof. Hale made some observations of its spectrum, using a small direct-vision spectroscope. A bright band was made out in the red, near C, and another was identified as the characteristic aurora-line. A very faint line, broad and hazy, appeared in the green, near the position of *b*, and a faint one near F.

THE PROPERTIES OF AMORPHOUS BORON.

THE properties of pure amorphous boron form the subject of a contribution to the current number of the *Comptes rendus* by M. Moissan. In our chemical note of March 3 (p. 421), the method was described by which M. Moissan has recently succeeded in preparing the amorphous form of boron in a state of almost perfect purity. The method consisted in reducing an excess of boric anhydride with powdered metallic magnesium, and subsequently repeatedly extracting the soluble products by acids. He now proceeds to describe the physical and chemical properties of the element as thus obtained. Pure amorphous boron is a fine chestnut-coloured powder, which may be readily moulded into adhesive masses by pressure. Its density is 2·45. It is infusible, even at the temperature of the electric arc. When heated in the air to a temperature in the neighbourhood of 700°, it inflames, and burns with formation of boric anhydride. If a small quantity is heated strongly in a test-tube, and, while hot, thrown into the air, a host of brilliant sparks are produced. When the powder is heated in a current of oxygen it burns with an intensely luminous flame, which, when the experiment is performed in a dark room, is observed to possess a green tint. The rays emitted are almost devoid of actinic power, the greater portion of the chemically active end of the spectrum being wanting. Pure amorphous boron reacts in a beautiful manner with sulphur at a temperature of about 610°, brilliant incandescence occurring with production of sulphide of boron. This latter substance is decomposed by water with liberation of sulphuretted hydrogen. Selenium reacts with amorphous boron in an analogous manner at a higher temperature, but without incandescence, the selenide of boron produced evolving hydrogen selenide when brought in contact with water. Tellurium, however, may be fused in presence of boron without any reaction occurring.

When amorphous boron is heated in an atmosphere of chlorine to 410°, combination accompanied by bright incandescence occurs with formation of chloride of boron, which, if the experiment is performed in a suitable apparatus, distils over into a receiver placed to intercept it. Bromine combines with boron to form the liquid bromide of boron at a temperature approaching 700°, the reaction likewise being accompanied by incandescence. Even bromine water attacks boron, although slowly, at the ordinary temperature, and an aqueous solution of bromine in potassium bromide attacks it rapidly. Iodine appears to be without action even at a red heat. Amorphous boron only combines directly with nitrogen at a high temperature, mere traces of the nitride being produced at temperatures below 900° when the powder is heated in a current of nitrogen; but at about 1200° combination rapidly occurs. The vapours of phosphorus, arsenic, and antimony do not react at available temperatures. When amorphous boron is heated in the electric arc in an atmosphere of hydrogen, boride of carbon is formed with a portion of the carbon of the poles.

The behaviour of metals towards amorphous boron is somewhat singular. The alkali metals may actually be distilled over the powder without any apparent trace of combination. Magnesium, on the contrary, combines with boron to form a boride at a low red heat. Iron and aluminium also form borides at a red heat, and silver and platinum react with even greater facility.

Acids react with amorphous boron with considerable energy. At 250° sulphuric acid is reduced to sulphur dioxide. Nitric acid in small quantities produces incandescence. Phosphoric anhydride is reduced at 800° to phosphorus. Arsenious and

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arsenic acids are reduced at low redness with sublimation of annuli of arsenic. When the powder is dropped into a warm solution of iodic acid, iodine is liberated, and if a mixture of amorphous boron and crystallized iodic acid is slightly warmed, it takes fire, and a cloud of iodine vapour is produced. Gaseous hydrofluoric acid attacks amorphous boron at low redness, hydrogen being liberated, and fluoride of boron produced. Hydrochloric acid only reacts at bright redness.

Steam does not react with boron below a red heat, but the moment incandescence commences at any point the decomposition proceeds with explosive violence, hydrogen being liberated and boric anhydride produced. Carbon monoxide is reduced by boron at 1200°, with formation of boric anhydride and deposition of carbon. When amorphous boron is heated to low redness in a current of nitrous oxide, incandescence is produced, and boron nitride and boric anhydride are formed. Nitric oxide, however, does not react with boron under these circumstances.

Metallic oxides are much more readily reduced by boron than by carbon. For instance, when a mixture of copper oxide and amorphous boron is heated in a glass test-tube, the heat produced in the act of reduction is so great that the glass immediately fuses. Oxides of tin, lead, antimony, and bismuth are immediately reduced upon slightly warming, and the mass becomes white hot. When peroxide of lead is rubbed in a mortar with amorphous boron, a violent detonation occurs. Oxides of iron and cobalt are reduced at a red heat, but the alkaline earths are not attacked by boron. When caustic potash is fused in contact with amorphous boron, a vigorous reaction occurs, with rapid evolution of hydrogen.

The great affinity of boron for oxygen may be readily shown by making a gunpowder in which carbon is replaced by boron; if such a mixture of amorphous boron, sulphur, and nitre is made, it will be found to explode considerably below the lowest red heat. If a few particles of amorphous boron are allowed to fall into fused potassium chlorate, quite a pyrotechnic display is produced. The behaviour of certain fluorides towards amorphous boron is interesting. Silver fluoride, for instance, reacts in the cold upon simple contact in a mortar, with incandescence and detonation. Many other fluorides are similarly decomposed on warming.

Sulphates of potassium and sodium are reduced to sulphides at a low red heat by amorphous boron with great energy, the mass becoming white hot. Fused nitre, however, only reacts at the temperature at which oxygen commences to be evolved, but fused nitrites of the alkali metals react with violence, and production of light and heat. Sodium carbonate, moreover, is reduced at the temperature of low redness with vivid incandescence. The reducing capabilities of boron appear to be even manifested in presence of water, for the powder rapidly decolorizes a solution of permanganate, and reduces solutions of ferric salts to ferrous. Silver nitrate in solution is reduced with deposition of crystals of metallic silver; gold chloride also yields an immediate precipitate of finely divided gold, and platinum chloride is likewise reduced with precipitation of platinum upon warming.

A. E. Tutton.

THE MANCHU RACE.

THE origin of the Manchus—the race to which the reigning dynasty in China belongs—is discussed by a writer in the *North China Herald*, of Shanghai. He says that the Tungus people are scattered about in Siberia and Manchuria in rather small communities of several hundreds or thousands each. In 1854 there were about thirty-five or forty thousand persons altogether in Siberia belonging to this race. Being hunters and fishers they find it best to live on the banks of rivers and on the seaside for fishing, and in wooded hill countries for hunting. They are met with, consequently, on the shores of the Baikal, and on the upper waters of the Lena, which rises among the mountains west of that inland sea. These few colonies of this race are under the jurisdiction of Irkutsk. Still farther west there are a tribe or two on the Yenissei. Those on the Lena are near the part where the mammoth and other wild animals formerly had their haunts. The frozen remains of these ancient creatures are found chiefly at the mouth of the Lena, which flows north to the Arctic Sea through about twenty degrees of latitude from the neighbourhood of Baikal. On the east of the Baikal, Nerchinsk and the banks of the Orchon and Onon Rivers are preferred by this people, who are irregularly scattered among the Buriat tribes in this part of Siberia. In the Amur territory of Russia they occupy parts of the sea coast, and are known as the Orotches and Goldi. It is because the salmon and other fish that they live on are found in abundance that they here build their movable huts. In the Russian Amur province there are about forty thousand of them, representing an ancient race which, as their language, joined with the facts of Chinese history, shows, must have occupied these same territories and prosecuted these occupations for thousands of years. In Kirin province there are, it is likely, a corresponding number, for the trade with China always demands sable skins, otter skins, squirrel skins, beavers, ermines, and fox skins in an ever increasing quantity. It is this demand for skins that maintains the tribes in the north part of Kirin province residing on the banks of the Usuri and other streams which flow north into the Amur.

The Tungus tribes to which the Manchus belong first appear in history in the Chow dynasty. They are the Sokdin or Sushen of that age, and they were powerful in the eleventh century before our era. They are mentioned in the preface of the Book of History, so that we have next to classical authority for their existence at that distant period as a powerful state. The historian Tso mentions them in the sixth century, and from the way in which he speaks they were the strongest race in Tartary at the time. But in the third century, after nine hundred years of honour, their star went down, and the age of Turkish ascendency arrived. The Hiung-nu Turks of the Han dynasty had emperors of their own, who at least on one occasion were received in China on terms of equality with the haughty sovereigns of their southern neighbours. They could call themselves eldest sons of heaven and brothers of the sun and moon, just as the Chinse could, and therefore they did so. But their star also went down. The Turkish race has been used to rule wild tribes for 2000 years. We know that the Hiung-nu were Turks by the words left of their vocabulary which are found recorded in Chinese history. But their power declined, and then the Sushen, or Tungus, rose again to influence, and it was because they lived in the eastern provinces, where the valleys are rich in productive power, and because they had the good sense to profit by Chinese teaching. When China conquered the Moukden province and Corea, a century before the Christian era, the result was that the habits of life of the Chinese and their moral and intellectual activity spread to the east and north-east. Tungus and Corean tribes came under this new influence, and grew more powerful in proportion to the progress they made in the adoption of a civilized life. The Tungus Ambassadors arrived at Loyang in A.D. 263 and 291; and a few years later, when the Tsin Emperor had removed his Court to Nanking, they appeared there. Probably they came from the mouth of the Newchwang River by sea, for we know that the Chinese junk-masters navigated the Gulf of Pechili fully 2000 years ago. The troops which subjugated Corea at that time were there in large junks. Meanwhile other branches of the Tungus race had become sufficiently powerful to disturb the quiet of North China. Among them were the Owan and Sien Pi. The Sien Pi and the Hiung-nu conquered large portions of Chinese territory. The Tungus people ruled in the province of Peking. The Turks occupied Shansi, and Tibetan tribes took possession of Shensi. Each of these races seized on that part of North China which lay contiguous to their homes in Tartary. This state of things lasted till the latter part of the fifth century, when the Chinese drove the Tartars out. Again, however, at the beginning of the twelfth century a Tungus race conquered North China, and was followed later by a Mongolian dynasty, to which the Chinese of north and south all submitted for a hundred years.

The Mongols as a race are probably an offshoot from Tungus stock. There are differences, but there is on the whole a great resemblance. The consanguinity that exists between Manchu and Mongol is greater than that which is found to prevail between Mongol and Turk; and therefore it may be concluded that the Tungus, either in Siberia or in Manchuria or on the Amur, threw off a branch which became Mongol. This would be of a very ancient date, for otherwise the grammars of the Mongol and Manchu would be more alike than they are. Genghis Khan and his tribe started on the conquest of the Asiatic continent from the neighbourhood of the gold mines in Nerchinsk, and the Mongols are not fishermen by preference nor hunters of the sable martin and the beaver. They are rather keepers of sheep and riders of horses and camels. They

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